Application No.: 10/541,700
Amendment dated: September 17, 2007
Reply to Office Action of March 16, 2007
Attorney Docket No.: 21295.0109US1

Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in this application:

Listing of Claims

Claim 1 (currently amended): ~~Method for confocal 4-pi microscopy, characterized by the following steps:~~

~~coherent illumination of a sample from two sides by one objective each with illumination light that has at least one illumination wavelength, whereby a stationary illumination wave with one main illumination maximum and with secondary illumination maxima is produced by interference of the illumination light in the sample, and~~

~~detection of the detection light emitted by the sample that exhibits at least one detection wavelength, that passes through the two objectives, whereby the detection light is made to interfere, thereby producing in the sample a detection pattern with one main detection maximum and with secondary detection maxima produced such that the secondary illumination maxima and the secondary detection maxima are located in different places.~~

A method of confocal 4-pi microscopy, comprising:

illuminating a sample with two coherent illuminating waves of an illumination wavelength;

producing by interference of the illuminating waves a stationary illumination wave with a main illumination maximum within the sample and secondary illumination maxima;

the illuminating waves inducing the sample to emit detection waves of a detection wavelength; and

producing by interference of the detection waves a detection pattern with a main detection maximum within the sample and secondary detection maxima;

wherein the secondary illumination maxima and secondary detection maxima are located in different places; and

wherein the location and/or intensity of at least one of the secondary illumination maxima and/or the secondary detection maxima is altered by positioning at least one Toraldo pupil filter at the optical path of at least one of the illuminating waves and/or the detection waves.

Claim 2 (canceled)

Claim 3 (previously presented): Method according to claim 1, wherein the sample is marked with at least one fluorescent dye.

Claim 4 (currently amended): Method according to claim 3, ~~wherein~~ further comprising excitation of the ~~sample is accomplished~~ at least one fluorescent dye by multiple-photon excitation~~, particularly by two-photon excitation~~.

Claim 5 (currently amended): Method according to claim 3, ~~wherein~~ further comprising excitation of the ~~sample comprises~~ at least one fluorescent dye using a ~~Foerster-resonant~~ Foerster-resonant energy transfer (FRET) ~~within the sample~~.

Claim 6 (currently amended): Method according to claim 3, ~~wherein the illumination light exhibits~~ further comprising illuminating the sample with a further illuminating wave of a further illumination wavelength, and ~~occurs~~ excitation of the at least one fluorescent dye via a virtual or via a real intermediate level.

Claim 7 (currently amended): Method according to claim 3, ~~wherein~~ further comprising excitation ~~occurs~~ of the at least one fluorescent dye via a higher excitation level~~, in particular via an S_0-S_2 transition~~.

Claim 8 (currently amended): Method according to claim 1, wherein the illumination wavelength to detection wavelength ratio is in a range of 0.5 to 0.9~~, in particular in a range of 0.6 to 0.8, in particular 0.75~~.

Claim 9 (currently amended): Method according to claim 3, wherein the at least one fluorescent dye ~~exhibits~~ has an excitation and an emission region, ~~whereby~~ and wherein the illumination wavelength is selected from the high-frequency portion of the excitation region and/or from the low-frequency portion of the emission region.

Claim 10 (currently amended): Method according to claim 1, ~~wherein~~ further comprising the detection waves passing through a detection ~~pinhole~~ aperture ~~is envisaged, whose aperture~~ with a diameter ~~is set~~ smaller than 1 Airy disc~~, in particular 0.7 to 0.8 Airy discs, in particular 0.7 Airy discs~~.

Claim 11 (currently amended): Confocal 4-pi microscope ~~with a light source that generates an illumination light that exhibits at least one illumination wavelength, and that is directable from two sides by one objective each onto a sample, in which a stationary illumination wave having a main illumination maximum and secondary illumination maxima is produced by interference of the illumination light in the sample, and with a detector to detect detection light emitted by the sample that passes through both objectives and that exhibits at least one detection wavelength, characterized in that the detection light interferes and a detection pattern is produced in the sample with a main detection maximum and with secondary detection maxima, whereby the secondary illumination maxima and the secondary detection maxima are located at different places.~~

comprising a light source capable of illuminating a sample with two coherent illuminating waves of an illumination wavelength;

wherein the illuminating waves are capable of producing by interference a stationary illumination wave with a main illumination maximum within the sample and secondary illumination maxima;

wherein the illuminating waves are capable of inducing the sample to emit detection waves of a detection wavelength;

wherein the detection waves are capable of producing by interference a detection pattern with a main detection maximum within the sample and secondary detection

maxima; and

wherein the secondary illumination maxima and secondary detection maxima are located in different places;

a detector detecting detection waves;

and

at least one Toraldo pupil filter at the optical path of at least one of the illuminating waves and/or the detection waves, the at least one Toraldo pupil filter being capable of altering the location and/or intensity of at least one of the secondary illumination maxima and/or the secondary detection maxima.

Claim 12 (canceled)

Claim 13 (currently amended): Confocal 4-pi microscope according to claim [[12]] 11, ~~wherein the minimum of one pupil filter exhibits~~ further comprising a phase plate ~~that comprises in particular regions of varying phase delay, in particular a λ/2 plate~~ at the optical path of at least one of the illuminating waves and/or the detection waves.

Claim 14 (currently amended): Confocal 4-pi microscope according to claim 11, wherein the ~~minimum of one~~ detection wavelength is selectable and the detector may be set to the selected detection wavelength.

Claim 15 (currently amended): Confocal 4-pi microscope according to claim 11, wherein the ~~minimum of one~~ illumination wavelength is selectable, and the light source can be set to the selected illumination wavelength.

Claim 16 (previously presented): Confocal 4-pi microscope according to claim 11, wherein the sample is marked with at least one fluorescent dye.

Claim 17 (currently amended): Confocal 4-pi microscope according to claim 16, wherein the light source is a laser, ~~particularly a pulse laser~~, and wherein excitation of the ~~sample~~

at least one fluorescent dye is achieved by multiple-photon excitation~~, particularly by two-photon excitation~~.

Claim 18 (currently amended): Confocal 4-pi microscope according to claim 16, wherein excitation of the ~~sample~~ at least one fluorescent dye comprises ~~Foerster-resonant~~ Foerster-resonant energy transfer (FRET) ~~within the sample~~.

Claim 19 (currently amended): Confocal 4-pi microscope according to claim 16, wherein the ~~illumination light exhibits~~ sample is illuminated with a further illumination wave of a further illumination wavelength, and excitation of the ~~sample~~ at least one fluorescent dye occurs via a virtual or via a real intermediate level.

Claim 20 (currently amended): Confocal 4-pi microscope according to ~~one of~~ claim 16, wherein excitation of at least one fluorescent dye occurs via a higher excitation level~~, particularly via an S_0-S_2 transition~~.

Claim 21 (currently amended): Confocal 4-pi microscope according to claim 11, wherein the illumination wavelength to detection wavelength ratio ~~lies~~ is in a range ~~between~~ from 0.5 to 0.9~~, in particular in a between range 0.6 to 0.8, in particular 0.75~~.

Claim 22 (currently amended): Confocal 4-pi microscope according to claim 16, wherein the at least one fluorescent dye ~~exhibits~~ has an excitation and an emission region, whereby the illumination wavelength lies within the high-frequency portion of the excitation region and/or the detection wavelength within the low-frequency portion of the emission region.

Claim 23 (currently amended): Confocal 4-pi microscope according to claim 11, ~~wherein the confocal 4-pi microscope exhibits~~ further comprising a detection ~~pinhole~~ aperture having an aperture diameter smaller than 1 Airy disc, ~~in particular 0.7 to 0.8 Airy discs, in particular 0.7 Airy discs~~ the detection waves passing through the detection aperture.